Certified Reference Material

Certificate of Analysis

ISO 17034:2016 ISO/IEC 17025:2017 ISO 9001:2015

Product ID: IARM-FeN40-18

Product Description: Nitronic 40 / UNS S21900

Description and Intended Use: This **Certified Reference Material** is covered under the scope of accreditation to **ISO 17034** by LGC Standards - Manchester, NH. As an ISO 17034 certified reference material, appropriate use of this material will fulfill the certified reference material and traceability requirements for use in **ISO 17025** accredited laboratories. This CRM may come in the form of a solid disk, or chips. The intended use of this CRM may include, but is not limited to, the calibration of instruments and the validation of analytical methods.

Certified Values listed in wt.% with associated uncertainties

C	0.019	± 0.001	Co	0.122	± 0.002	Cr	19.45	± 0.09	Cu	0.421	± 0.008
Mn	9.13	± 0.06	Mo	0.343	± 0.007	N	0.348	± 0.006	Nb	0.032	± 0.002
Ni	6.42	± 0.04	P	0.025	± 0.001	S	0.0012	± 0.0003	Si	0.31	± 0.01
Sn	0.0081	± 0.0007	V	0.086	± 0.003	W	0.030	± 0.002			

Indicative Values listed in ppm

Al	(70)	As	(<50)	B	(<50)	Fe	(63.5%)	Mg	(<10)	O	(20)	Pb	(<50)
Sb	(<20)	Ta	(<20)	Ti	(30)	Zr	(<50)						

Homogeneity and Uncertainty: "Uncertainty" values, as reported adjacent to certified concentration values, are based on a 95% Confidence Interval. These estimated uncertainties include the combined effects of method imprecision, material inhomogeneity, and any bias between methods. Homogeneity data from experimental XRF results are reflected in both the overall statistics and certified data. Homogeneity samples are selected by a systematic sampling procedure. The number of samples may be determined by equation 1, where N_{prod} is the number of units produced and N_{min} is the number of samples used for homogeneity testing. These samples are arranged in a simple randomized design such that each sample is analyzed multiple times by XRF. Homogeneity may also be determined within sample using an applied version of ASTM E826. A single factor ANOVA is used to calculated uncertainty due to inhomogeneity (U_{hom}). Uncertainty of the material is calculated by equation 2, where H=U_{hom}, S= Standard deviation, t= t-value at 95% CI, and n= number of observations.

$$1. N_{MIN} = \max\left(10, \sqrt[3]{N_{PROD}}\right) \qquad 2. U_{CRM} = \frac{\sqrt{H^2 + S^2}}{\sqrt{n}} * t$$

Certification Laboratories: Much of the analytical work performed to assess this material has been carried out by laboratories with proven competence, as indicated by their accreditation to ISO 17025. It is an implicit requirement for this accreditation that analytical work should be performed with due traceability, via an unbroken chain of comparisons, each with stated uncertainty, to primary standards such as the mole, or to nationally- or internationally-recognised reference materials. Of the individual results herein, some have traceability (to the mole) via primary analytical methods. Some are traceable to substances of known stoichiometry. Most have traceability via commercial solutions. Furthermore, some results have additional traceability to NIST standards, as part of the analytical calibration or process control.

- LGC Standards - Manchester, NH
- Dirats Laboratories - Westfield, MA
- NSL Analytical Services - Cleveland, OH
- Laboratory Testing, Inc. - Hatfield, PA
- Element Material Technology - Middlesbrough, UK
- TEC Eurlab – Campogalliano, Italy
- Connecticut Metallurgical, Inc. - East Hartford, CT
- IMR Test Labs - Lansing, NY
- SGS MSi - Melrose Park, IL
- Scrooby's Laboratory Service - Rynfield, South Africa
- AnchorCert Analytical - Birmingham, UK
- Sheffield Assay Office - Sheffield, UK
- EAG Laboratories - Liverpool, NY
- TCR Engineering Services - Maharashtra, India
- Luvak Inc. - Boylston, MA
- Universal Scientific Laboratory – Revesby Australia

Instructions for Use: The test surface is on the opposite side of the labeled surface, which includes the material identification. The entire thickness of the unit is certified. However, the user is cautioned not to measure disks less than 2 mm thick when using X-ray fluorescence spectrometry. Each packaged disk has been prepared by finishing the test surface using a lathe. The user must determine the correct surface preparation procedure for each analytical technique. The user is cautioned to use care when either resurfacing the disk or performing additional polishing, as these processes may contaminate the surface. The minimum sample size for chips should be individually evaluated based on the analytical technique used; this would typically be greater than 0.1 grams. The material should be stored in a cool, dry location when not in use. Chips are not recommended for gas analysis.

Period of Validity: The certification of this material is valid indefinitely, within the uncertainty specified, provided the material is handled and stored in accordance with the instructions stated on this certificate. The certification is nullified if the material is damaged, contaminated, otherwise modified, or used in a manner for which it was not intended.

Kimberly Halkiotis, Global Product Manager

September 30, 2021
Certification Date

Conditions of Sale and Supply: All CRMs & RMs sold are subject to applicable LGC Standard Terms and Conditions of Sale.

The following data represents all pertinent information reported as it applies to the chemical characterization of this material.

	Al	As	B	C	Co	Cr	Cu	Fe	Mg	Mn	Mo	N	Nb	Ni
1	0.0020	0.0041	0.0001	0.0152	0.1140	19.020	0.3973	62.280	0.0001	8.8941	0.3230	0.3300	0.0220	6.2610
2	0.0021	0.0048	0.0003	0.0156	0.1143	19.200	0.3990	63.000	<0.001	8.9002	0.3260	0.3430	0.0270	6.2790
3	0.0029	0.0050	<0.001	0.0160	0.1150	19.255	0.4000	63.130		8.9560	0.3290	0.3437	0.0284	6.3510
4	0.0030	<0.001	<0.005	0.0160	0.1200	19.270	0.4100	63.227		9.0200	0.3297	0.3440	0.0294	6.3587
5	0.0032	<0.005		0.0180	0.1200	19.290	0.4110	63.440		9.0554	0.3300	0.3440	0.0295	6.3700
6	0.0047			0.0180	0.1200	19.296	0.4150	63.473		9.0900	0.3300	0.3456	0.0301	6.3700
7	0.0050			0.0180	0.1210	19.320	0.4150	63.590		9.1320	0.3350	0.3460	0.0302	6.3900
8	0.0050			0.0187	0.1210	19.400	0.4160	63.653		9.1400	0.3380	0.3470	0.0310	6.4130
9	0.0056			0.0191	0.1216	19.423	0.4174	63.950		9.1490	0.3392	0.3500	0.0312	6.4300
10	0.0060			0.0192	0.1220	19.440	0.4180	64.000		9.1533	0.3403	0.3510	0.0321	6.4300
11	0.0067			0.0198	0.1222	19.450	0.4200	64.980		9.1560	0.3410	0.3612	0.0325	6.4400
12	0.0080			0.0199	0.1230	19.460	0.4208			9.1633	0.3423	0.3650	0.0330	6.4501
13	0.0100			0.0200	0.1250	19.466	0.4235			9.1700	0.3474		0.0330	6.4555
14	0.0101			0.0212	0.1250	19.486	0.4270			9.1740	0.3500		0.0338	6.4590
15	0.0106			0.0221	0.1254	19.486	0.4300			9.1800	0.3526		0.0340	6.4630
16	0.0110			0.0230	0.1280	19.500	0.4330			9.1900	0.3540		0.0344	6.4900
17	0.0110				0.1280	19.540	0.4360			9.2588	0.3660		0.0347	6.4900
18	0.0120				0.1320	19.590	0.4460			9.2610	0.3700		0.0350	6.4943
19	0.0140					19.660	0.4600			9.3860	0.3720		0.0380	6.5170
20	0.0150					19.690							0.0400	6.5450
21	<0.01					19.800							0.0400	
22						19.830								
Mean	0.0074	0.0046	0.0002	0.0187	0.1221	19.449	0.4208	63.520	0.0001	9.1279	0.3429	0.3475	0.0324	6.4228
STDV	0.0041	0.0005	0.0001	0.0023	0.0048	0.1938	0.0157	0.6800		0.1224	0.0147	0.0090	0.0042	0.0747
Certified	**(0.007)**	**(<0.005)**	**(<0.005)**	**0.019**	**0.122**	**19.45**	**0.421**	**(63.5)**	**(<0.001)**	**9.13**	**0.343**	**0.348**	**0.032**	**6.42**
U_{CRM}				**0.001**	**0.002**	**0.09**	**0.008**			**0.06**	**0.007**	**0.006**	**0.002**	**0.04**
Methods	IM,I,X,O	IM,O,X	IM,O	C,O	IM,I,X,O	IM,I,X,O,W	I,X,O	X,I,O,W	IM,O	I,X,IM,O,W	I,X,IM,O	F,C,O	IM,I,X,O	I,X,O,W

	O	P	Pb	S	Sb	Si	Sn	Ta	Ti	V	W	Zr		
1	0.0011	0.0200	0.0020	0.0003	0.0011	0.2560	0.0070	0.0017	0.0003	0.0778	0.0220	0.0021		
2	0.0021	0.0207	0.0050	0.0006	0.0018	0.2720	0.0080	<0.001	0.0010	0.0780	0.0250	<0.00005		
3	0.0022	0.0211		0.0008	0.0020	0.2800	0.0081		0.0048	0.0800	0.0270	<0.005		
4	0.0036	0.0219		0.0008		0.2890	0.0081		0.0070	0.0821	0.0270			
5		0.0230		0.0010		0.2890	0.0086		<0.005	0.0826	0.0270			
6		0.0233		0.0010		0.2960	0.0090			0.0830	0.0288			
7		0.0234		0.0010		0.3053				0.0835	0.0290			
8		0.0240		0.0011		0.3080				0.0836	0.0300			
9		0.0248		0.0012		0.3112				0.0842	0.0300			
10		0.0250		0.0012		0.3127				0.0850	0.0305			
11		0.0255		0.0015		0.3188				0.0850	0.0307			
12		0.0260		0.0020		0.3250				0.0870	0.0308			
13		0.0264		0.0023		0.3250				0.0880	0.0320			
14		0.0270		0.0023		0.3260				0.0880	0.0330			
15		0.0270		<0.003		0.3270				0.0880	0.0335			
16		0.0271		<0.003		0.3310				0.0920	0.0346			
17		0.0273				0.3377				0.0970	0.0346			
18		0.0277				0.3400				0.0980	0.0350			
19		0.0280				0.3420				0.0980	0.0367			
20		0.0280												
21		0.0280												
Mean	0.0022	0.0250	0.0035	0.0012	0.0016	0.3101	0.0081	0.0017	0.0033	0.0864	0.0304	0.0021		
STDV	0.0010	0.0026	0.0021	0.0006	0.0005	0.0242	0.0007		0.0032	0.0061	0.0038			
Certified	**(0.002)**	**0.025**	**(<0.005)**	**0.0012**	**(<0.002)**	**0.31**	**0.0081**	**(<0.002)**	**(0.003)**	**0.086**	**0.030**	**(<0.005)**		
U_{CRM}		**0.001**		**0.0003**		**0.01**	**0.0007**			**0.003**	**0.002**			
Methods	C,F	IM,I,X,O W	O	C,X,IM, O,I	IM,X,O	IM,I,X,O ,W	I,IM,O, X	O	I,IM,O,X	IM,I,X,O	IM,X,I,O	IM,O,X		

Legend: W = Classical, C = Combustion, F = Fusion, A = AA or GFAA, I = ICP or DCP, IM=ICP-MS, D = DC Arc, O = AES, X = XRF, G = GDAES or GDMS, H = Hollow Cathode AES

LGC